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1991
ANNUAL
REPORT

ALBERTA SPECIAL CROPS AND HORTICULTURAL RESEARCH CENTER

Alberta
AGRICULTURE

DIRECTOR'S REPORT

The Alberta Special Crops and Horticultural Research Center (ASCHRC) is a branch of Alberta Agriculture's Plant Industry Division. Its staff conduct applied research, extension and development programs and cooperate with other research organizations. The mandate of crop diversification and industry development is achieved by maintaining working relationships with industry organizations and commodity groups.

During 1991 assistance was provided to the Fruit Growers Society of Alberta for the purchase of a new saskatoon berry harvester. It is hoped that the purchase of this new equipment will enhance the commercialization of this crop. The small fruit industry also continued to receive support from the ASCHRC with bulk ordering of day-neutral strawberries. Development of an essential oil industry remained a priority. Efforts were continued with crops such as monarda, mints, basil and lemon bergamot, which all offer some commercial potential.

Staff continued to administer the Alberta Greenhouse Industry Assistance Program. This program has provided the Alberta greenhouse industry with the opportunity to upgrade facilities and to initiate crop diversification activities. Staff also continued their active involvement in producer and industry associations including the Alberta Greenhouse Growers Association, the Alberta Market Gardeners Association, the Alberta Potato Research Association, and the Alberta Horticultural Congress and Trade Show.

Staff changes were minimal in 1991. They included the resignation of D. Kaminski, Diagnostician, and the transfer of J. Holley from the Post Harvest Physiology Program to the diagnostician position. Two positions were eliminated due to budget reductions: the stockkeeper position (incumbent W. Coffey) and the vacant agrologist position. J. Clark, Librarian/Hostess, was on long term disability throughout the year.

Program funding continued to be a major concern. Budget reductions further limited the ability to hire wage employees, to purchase equipment and operational supplies, and also to travel. We acknowledge the support received from sources such as Farming for the Future for specific project funding. Travel to a number of conferences was supported by producer and industry associations. We particularly acknowledge Red-Hat Cooperative Ltd. and the Alberta Greenhouse Growers Association for their support of J. Butt's travel to Holland.

Detailed program reviews were conducted for the Greenhouse Crops, Potato, Fruit, Nursery Crops and Ornamentals, Weed Control, Food Science, and Entomology Programs.

This annual report is a summary of ongoing research and extension programs. More information on any program, including detailed research reports, is available on request.

Thomas R. Krahn, P.Ag.
Director

93-00561/

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ADMINISTRATIVE SERVICES SECTION

This section provides administrative support including purchasing, accounting, budgetary control, personnel services, library and hostess activities, automated information processing, and general office management.

Section Staff

Thomas R. Krahn, B.Sc. (Ag), M.Sc., P.Ag. ..... Director
Huber Ellis ..... Administrative Officer
Priscilla Petersen ..... Secretary & Personnel
Anna Moeller ..... Purchasing/Accounting Officer
Betty Ann Humphreys ..... Receptionist & Timekeeper
Joyce Clark ..... Librarian & Hostess

A major accomplishment in 1991 was the installation of the AS 400 computer system. When fully operational, it will connect the ASCHRC to a province-wide network within the Department of Agriculture. A number of personal computers were purchased thus enhancing the overall data processing capabilities.

Visitor services were provided despite the absence of the librarian/hostess. The number of visitors to the ASCHRC and the number of organized tours hosted decreased from previous years. The annual field day hosted approximately 1500 visitors. Commodity based events, such as tours and field days, were also hosted. These activities continue to be an excellent means of transferring technology.

Operational budgets continued to be reduced. Travel, material and supply purchases, fixed asset purchases, and casual manpower hiring were all affected.

SITE OPERATIONS SECTION

This section is responsible for the grounds, farm operations, machinery/vehicle maintenance and shop operation, stockkeeping, and the Occupational Health and Safety Program. Site development, shelterbelt planning, planting and maintenance, irrigation system maintenance, land preparation and weather services are other responsibilities. It is also the contact with Project Management and Property Management staffs of Alberta Public Works Supply and Services. The site manager continued responsibility for operation of the growth chamber facility.

Joe Chomistek, B.Sc. (Ag), P.Ag.	Site Manager
Henry Christesen	Farm Manager
Roland Williams	Senior Mechanic
Barry Merkl	Mechanic
William Wise	Farm Worker
Randy Hellmer	Farm Worker
Greg Feth	Grounds Technologist
Bill Coffey	Stockkeeper

Replacement of the production greenhouses was completed. This project took more time and effort than had originally been anticipated. The additional greenhouse and hoop house space, however, will add to the overall research capacity. No other capital works projects were undertaken in 1991.

Elimination of the stockkeeper's position created a number of demands on other section staff. Responsibility for mail delivery was assumed by Canada Post which commenced mail delivery to the new campus of Medicine Hat College and extended that service to the ASCHRC.

HORTICULTURAL CROP PRODUCTION SECTION

Programs in the Horticultural Crop Production Section provide research and extension services for Alberta's horticultural industries. The objectives of the section are:

- to improve the quality of horticultural crops produced in Alberta;
- to increase profits for producers by increasing yields and optimizing management inputs; and
- to promote the development of horticultural crop production.

Industries supported include: fresh, processed, and seed potato; fresh and processed vegetable; greenhouse flower and vegetable; nursery and landscaping; and small and native fruit. Most of the programs include both cultivar evaluation and production research. Extension activities include workshops, short courses, field days, study groups, and individual consultation.

Section Administration and Potato Program

Clive A. Schaupmeyer, B.Sc. (Ag), M.Sc., P.Ag. ..... Section Head and Potato Specialist
Mayumi Tanigami-Bunney ..... Secretary
Cathy Feth, Dipl. Hort., B.S.A. ..... Technologist

Vegetable Crops

Paul Ragan, B.Sc. (Ag), M.Sc., Ph.D. ..... Research Horticulturist
Mike Blades, Dipl. Hort. ..... Technologist

Fruit Crops

Lloyd Hausher, B.Sc. (Ag) ..... Research Horticulturist
Te-Sen Pih, B.Sc., M.Sc. ..... Technologist

Nursery Crops and Ornamentals

J. Mason Robertson, B.A., B.Sc., Ph.D. ..... Research Horticulturist
Nigel Seymour, Dipl. Hort. ..... Technologist

Greenhouse Crops

Judy Butt, B.Sc. (Ag), M.Sc., P.Ag. ..... Research Horticulturist
Murray Briant, Dipl. Hort. ..... Technologist

POTATO PROGRAM

Program Leader: C. Schaupmeyer
Technologist: C. Feth

The objectives of the Potato Program are:

- to assist in the selection and development of improved potato cultivars and
- to establish methods for improving quality and maximizing economic yields in Alberta's potato industry.

These are accomplished through research, extension, and service.

Research Projects

Potato Cultivar Improvement

The ASCHRC participates in cultivar evaluation in three ways. First, as a cooperator in the Prairie Regional Trials, we plant several cultivar evaluation trials. Second, we produce seed for the regional trials for six regional trial sites in the Prairies. Third, we participate with industry evaluation of advanced cultivars that have graduated from the regional trials.

Prairie Potato Regional Trials

Approximately 300 lines were grown in the Regional Trials at Brooks. Data were collected on 39 agronomic and quality factors including yield, maturity, specific gravity, culinary and processing quality. Data from these trials were sent to D. Lynch at the Agriculture Canada Research Station, Lethbridge, for analysis and summarization for the Prairie Potato Breeding and Selection Committee of which we are members. Data from the regional trials are published in the annual report: *Progress Report, Prairie Potato Regional Trials*.

Alberta Potato Industry Cultivar Evaluation

The Potato Industry Cultivar Trials were established to evaluate, on a commercial scale, new potato cultivars that have graduated from the Prairie Potato Regional Trials. The trials enable growers and processors to gain first-hand experience with new cultivars in the field and processing plant. Potato growers and staff from Hostess Foods Products Ltd., Old Dutch Foods Ltd., and York Farms Division of Canada Packers Inc., cooperate with the ASCHRC staff in the Potato Industry Cultivar Trials.

Industry evaluation is lacking technical support. Many people are involved but no one is available to oversee this important function on a regular basis. Agriculture Canada has taken on the responsibility of propagating seed for industry evaluation, and there is now a reasonably stable source of seed of graduating cultivars.

Potato Cultural Research

The production research trials continue to be directed at planting management. Potato planting management studies between 1986 and 1991 had the objective of determining optimum planting management techniques for seed and commercial potatoes grown under irrigation.

In the past six years planting management studies in the field investigated: productivity of seed-piece types, planting dates, plant and stem populations, in-row spacings, and comparisons of small mother seed lots and variably sized mother lots. Greenhouse studies investigated the effects of seed type on emergence and stand.

The studies established that seed pieces cut from large mother tubers are not as productive as pieces cut from smaller mother tubers. Seed pieces cut from large mother tubers have a lower final stand than do pieces cut from smaller mother tubers. They have fewer stems, and they result in more variability of the harvested tubers.

Recommendations from seed-piece and other planting-management studies include: elimination of seed tubers greater than 225 g, closer in-row spacing for commercial production of some cultivars, closer in-row spacings for irrigated seed production, and optimum planting dates between April 20 and May 10 in southern Alberta.

The most significant conclusion from these studies, and from studies conducted in Washington State, clearly show that large mother tubers, greater than 225 g, should be eliminated from seed lots.

Service Projects and Extension

Seedlings of approximately 150 cultivars were propagated for the Prairie Potato Breeding Program regional trials in Alberta, Saskatchewan, and Manitoba. Approximately 300 hills each of advanced seedlings and 50 hills each of early lines were grown, stored at ASCHRC, and subsequently shipped to other cooperators in the Prairie Provinces.

The potato specialist provides extension service to growers and industry personnel through direct contact, newsletters and factsheets, and presentations at conferences and workshops. Revision of the *Alberta Potato Production Guide* was continued and will be available for the 1992 planting season.

VEGETABLE PROGRAM

Program Leader: P. Ragan
Technologist: M. Blades

The Vegetable Program serves the fresh and processing sectors of Alberta's expanding vegetable industry through applied field research and industry extension activities. The fresh vegetable industry in Alberta consists of both commercial (wholesale) and market garden producers. Processing growers provide vegetables for the canning and freezing industry. Variety evaluation and earliness enhancement of crops through improvements in cultural management are the main research activities of the Vegetable Program. Education and technology transfer are carried out through on-farm visits and participation in commodity organizations' conferences and workshops.

Research Projects

Variety Evaluation

Details of results on varieties tested are reported in the ASCHRC Pamphlet 92-5 *Vegetable Variety Trials - 1991*.

In 1991, 650 varieties of 16 types of vegetables were evaluated. Direct seeding and transplanting, dates of planting, and successive seeding regimes of five types of vegetables were evaluated. Many of the entries are advanced breeding lines from Europe and the United States. The quality of storage crops such as carrots, cabbage, cooking onions and acorn squash were evaluated in 4- and 6-month storage trials.

Cultural Trials

Detailed results and discussions of cultural trials are reported in the ASCHRC Pamphlet 92-4 *Vegetable Cultural Trials - 1991*.

Broccoli population trial

Market requirements for high-yielding broccoli consisting of long, thin hollow-free stems can best be achieved by planting broccoli 20 cm between plants in the row. Closer spacings between plants in the row may increase yield further but overcrowding of plants could reduce quality of florets and stems. If weed control is not a major problem and inter-row tillage equipment is available, twin-row plantings on 20-cm centres with 60-90 cm between outside rows are recommended.

Winter squash population trial

There appears to be some indication that higher yields of fruit in winter squash can be expected as both spacings between plants in the row and between rows decrease. However, the trend toward increased yields is offset by more immature fruit per plant, regardless of variety. Individual fruit size and weight also tended toward an increase as spacings between plants in the row and between rows increased.

Tunnel cover evaluation

For both earlier fruit production and higher total yield in slicing cucumbers, a tunnel constructed of clear poly rather than Reemay and white poly tunnels is recommended. Higher mean day maximum temperatures recorded over a 2-week period contributed to this yield response.

In the event of chilling or freezing temperatures, however, Reemay can offer from 1-2½°C protection over clear and white poly materials. This low-temperature insulation property of Reemay can be very important in both early spring and late summer when freezing temperatures can be expected.

Cauliflower curd initiation

A second attempt was made to devise a prediction model for maturity using mean day temperature accumulations from planting to curd initiation. In screening six industry standard varieties, there was no strong correlation between 1990 and 1991 data.

The trial will continue in 1992.

Extension and Service Activities

A one-to-one, on-farm extension service was provided to growers in the southern region of the province. Specialized equipment was loaned to growers to encourage adoption of new technology. Popular items included precision drills, transplanters and plasticulture equipment. Seed belt punching and calibration service was provided for producers who use Stanhay belt seeders. Growers seed lots are matched with the best combination of belt hole size and number of holes to ensure optimum plant density in the field.

Seminars for vegetable growers were given to provide variety recommendations and guidelines to data interpretation as reported in the ASCHRC Pamphlets 91-4 and 91-5.

The Processing Vegetable Growers Newsletter and Market Gardeners Newsletter were produced throughout the year. Numerous talks to amateur gardening groups were also given.

FRUIT CROPS PROGRAM

Program Leader: L. Hausher
Technologist: T.S. Pih

The Fruit Crops Program serves the expanding berry and bush fruit industry in Alberta through applied research, development, and extension activities. Strawberries, raspberries, and saskatoons are the main crops studied, although other fruit crops are evaluated for their commercial potential. Extension and development activities are directed to producers and producer organizations like the Alberta Market Gardeners Association and Fruit Growers Society of Alberta.

Research Projects

Details on cultivar evaluation and cultural trials are reported in the ASCHRC Pamphlet 92-6, 1990 *Fruit Crop Trials*.[1]

Strawberries

Evaluation of Junebearing strawberries

Twenty-four Junebearing cultivars, established in 1990, were evaluated for yield and hardiness. Very little winter damage was observed to plants although bud damage was evident on Californian and west-coast cultivars. The cultivars Kent and Glooscap were the top producers. A new Nova Scotia cultivar Cavendish also produced well.

Junebearing strawberry fruiting enhancement

A trial was established in 1990 to evaluate the effects of fibre cover application and times of removal on the yield of Kent and Glooscap Junebearing cultivars. Slight production increases of Kent were observed with some treatments. Production of Glooscap was not enhanced with use of fibre.

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[1]Note: This trial report also includes results of strawberry, raspberry and saskatoon trials conducted at the Alberta Tree Nursery and Horticulture Centre, Edmonton.

Junebearing strawberry winter protection evaluation

A trial was established in 1990 to evaluate the winter protection effect of two densities of row cover, alone, and in combination with straw, on the cultivars Kent and Glooscap. Late removal of the heavy fibre row cover with and without straw mulch improved yields of Kent. Late removal of only straw mulch (standard) resulted in the best yields of Glooscap.

Evaluation of day-neutral strawberry cultivars

Seven day-neutral cultivars were planted in a non-replicated design. Plants were deblossomed for six weeks and derunnered for 10 weeks. They were harvested from July 11-September 16. The cultivar Tribute produced 27.5 t/ha.

Evaluations of overwintered day-neutral strawberry cultivars

Day-neutral strawberries were planted and harvested in 1990 and were overwintered under straw mulch. The cultivar Tristar produced the highest total and marketable yield in the second year of production.

Effects of deblossoming and derunnering on yield of day-neutral cultivars

Single rows of the cultivars Fern, Irvine and Tristar day-neutral strawberries were established in 1991. Treatments included deblossoming plants for six weeks, derunnering plants for 10 weeks, and combinations. The cultivar Fern produced increased yields if derunnered without deblossoming. The cultivars Tristar and Irvine produced increased yields if deblossomed without derunnering.

Day-neutral fruiting enhancement

A trial was established to evaluate the effect on fruiting and yield of fibre row covers removed at different times, clear poly mulch and poly tunnels on the cultivars Fern and Tristar.

The clear poly tunnel applied at planting and removed after four weeks provided highest yields of both cultivars.

Raspberries

Evaluation of summer-fruiting raspberry cultivars

Thirteen cultivars and ten advanced selections of summer-fruiting raspberries were established in 1987. Five cultivars, Amethyst, Chief, Matsqui, Gatineau and Fraser and one selection, BR-3, produced higher yields than the standard cultivar Boyne.

Evaluation of primocane raspberry selections

Three primocane raspberry selections from Morden, Manitoba, were evaluated. The selection, 8008, produced the highest yield (7.4 t/ha) during the harvest period from July 22 to September 16.

Evaluation of primocane raspberry cultivars

Five cultivars of fall-bearing raspberries were established in 1990 as part of the North American Primocane Raspberry Genotype by Environment (GxE) Study. In the first year of harvest, the cultivar Summit was the top performer producing 4.8 t/ha of fruit.

Saskatoons

Saskatoon cultivar evaluation

Growth characteristic records and first crop yields were obtained from ten cultivars established in 1988.

Saskatoon plant stock evaluation

A trial was established in 1988 to evaluate types of plant stock of Smoky and Northline saskatoons. Data recorded during the fall of 1991 included plant height and number and height of suckers. Plant material was established from seed, taken from plant suckers, or propagated by tissue culture. The sucker and clonal parent stock of Northline significantly produced higher yields than the seedling parent stock. No significant yield differences were observed between parent types of Smoky.

Extension and Service Activities

Fruit Facts, a newsletter providing berry producers with up-to-date production and marketing information, was published monthly. Articles were prepared regularly for the Alberta Market Gardeners Association (AMGA) and Fruit Growers Society of Alberta newsletters. A berry production school was conducted in Red Deer for commercial growers and two research field days were held. Assistance was given to the AMGA in the bulk ordering of strawberry plants for Alberta producers.

The fruit specialist continued as secretary of the Alberta Professional Horticultural Growers Congress and Foundations Society, the Alberta Horticultural Congress Foundation, Alberta Horticultural Congress and Trade Show, and the AMGA. The Northwest Territories government was assisted with a berry production workshop in

Ft. Smith. Presentations were made to research, commodity, and advisory groups during the year, including a saskatoon production seminar, Saskatoon, and Saskatchewan Hort Days. A Fruit Crop Program review was held in March.

NURSERY CROPS & ORNAMENTALS PROGRAM

Program Leader: M. Robertson
Technologist: N. Seymour

The Nursery Crops and Ornamentals Program serves Alberta's nursery and landscape industries. Research, extension, and maintenance of two large plant collections are the major elements of the program.

Research Projects

Field Evaluation Trials

Prairie regional trials

Established in 1958, the Prairie Regional Trials test the hardiness of woody perennials on the Canadian Prairies. The Agriculture Canada Research Station in Morden, Manitoba, is responsible for coordinating the project and supplying the plant material. Brooks, one of the four original sites, remains one of eight sites involved in the tests today.

Growth and hardiness recommendations of graduating selections or varieties are sent annually to the ornamental scientist at Morden for summarizing and reporting to the nursery industry.

Regional woody plant test program

This ongoing cooperative trial between Landscape Alberta Nursery Trades Association (LANTA) and Alberta Agriculture complements the Prairie Regional Trials. Trees and shrubs are tested for five years at eight sites that represent the variety of climatic conditions in Alberta. Staff from the Alberta Tree Nursery & Horticultural Centre and the ASCHRC evaluate this material.

The University of British Columbia plant introduction scheme

Participation in this program is under the direction of B. MacDonald, University of British Columbia. Its aim is to introduce new cultivars and species to Alberta. Potentilla cv. Yellow Gem is a recent introduction from the program.

All America Selections

All America Selections is a non-profit organization dedicated to promoting the development and introduction of improved cultivars of flowers and vegetables. The ASCHRC is one of approximately 35 flower trial sites in North America.

Nursery Crop Research

Since the ornamental scientist started in June 1990 the program has emphasized studies in cold hardiness.

Hormonal treatments of marginally hardy species

Most woody species become cold-tolerant as they mature. Marginally hardy species which frequently fail in the juvenile phase of their life cycle, can tolerate Alberta's winters if they achieve maturity. The aim of this study is to find treatments that would enable growth of marginally hardy plants through the tender juvenile phase. Saplings of eight marginally hardy species, *Acer platinoides, Acer saccharum, Acer saccharinum, Juglans nigra, Pinus strobus, Pinus resinosa, Gleditsia triocanthus*, and *Catalpa bignoides*, were treated with varying concentrations of ethrel or abscisic acid in September, 1991. The plants will be evaluated in the spring of 1992 for survival, winter injury, and growth.

Extending the growing season

Alberta growers are often at a disadvantage to their competition in provinces and states that have longer growing seasons. More growth can be forced from nursery stock, but it is at the risk of interfering with the hardening process. If treatments could be found that would effectively accelerate hardening in late summer, then growers could force extra growth and still have time to harden their material.

A related problem is that of slow-growing trees. Some hardy and attractive species are impractical as nursery stock because of their slow growth; e.g., *Pinus flexilis* and *Pinus cembra*. If these could be forced to increase their annual growth and still be hardened before winter, growers would have some highly desirable new species for market.

In 1991, high levels of water and nutrients were applied to several species, including some slow-growing trees, to force extra growth. The forcing treatments will be repeated in 1992 and the plants will be treated with hardening hormones in the late summer. Effects of forced growth and hormonal treatments will be evaluated in 1993.

Water Relations Experiments

Hydrophilic polymers have been available for several years. Their intended use is to retain soil water for use when drought conditions occur. Polyacrylamides absorb several times their weight in water but how much of this water is available to the plant under drought conditions is unknown. Plant performance trials with polyacrylamides have yielded mixed results.

Experiments that examine the effects of polyacrylamides on the action of water in the soil and in plants were started in 1991. Fields experiments with saskatoons and Douglas fir were established in the summer of 1991. Data on water potential, plant growth and transpiration will continue to be collected. A related experiment was started in the greenhouse in late 1991.

Salinity and cold tolerance of ornamental trees

This experiment is designed to determine the effects of salt stress on the hardiness of woody ornamental plants. This is a cooperative project under the direction of C. McKenzie, Soil and Water Specialist.

Overwintering container stock

Studies were started in 1989 to define conditions that promote hardening and to test the effects of abscisic acid analogues. Data were analyzed and no significant effects of the treatments were detected.

Apical Dominance Studies

This is a cooperative project with the University of Calgary and Agriculture Canada for the purpose of defining the hormonal system that regulates apical dominance. Quackgrass was used because it is a good model plant that yields high numbers of rhizomes. Results from these experiments will advance our knowledge of the apical dominance system in nursery stock.

Extension Services

Extension services are available to the landscaping and nursery industries, as well as golf courses and city parks. The specialist also handles calls from the general public when the seasonal information officer is unavailable.

Reference Collections

Two large demonstration plots serve as reference collections for researchers, industry, and the public.

The Golden Prairie Arboretum

Established in 1985, the Golden Prairie Arboretum contains over 500 specimens, each representing a different species or cultivar of broadleaf woody plant. The collection includes most of the deciduous trees and shrubs that can be grown on the Prairies.

The Forever Green Pinetum

This collection of coniferous plants was established in 1988 and complements the Golden Prairie Arboretum. Approximately 30 new additions were planted in the autumn of 1991.

GREENHOUSE CROPS PROGRAM

Program Leader: J. Butt
Technologist: M. Briant

The Greenhouse Crops Program serves southern Alberta's greenhouse vegetable and floriculture industry by providing a comprehensive extension service and conducting applied greenhouse research. Extension services include crop management information, diagnosis of crop disorders, and soil and tissue test interpretations.

Research Projects

Vegetable Crops

Production of long English seedless mini-cucumbers

The production of two mini-cucumbers, Sahara and Minisol, with two pruning methods (2 fruit per node and 3 fruit per node) was evaluated. Data analyses were not complete at time of publication.

DIF Temperature Management for Tomato Transplant Production

Tomato seedlings cv. Caruso were placed in growth chambers at the first true-leaf stage and grown at two temperature regimes: 20°C day and 18°C night (positive DIF) and 20°C day and 20°C night (zero DIF) until plants reached the transplant stage. Plant height was reduced at 20°C day and 20°C night but stem diameter, leaf number, and dry weight were not affected.

DIF Temperature Management for Cucumber Transplant Production

Cucumber seedlings cv. Corona were placed in growth chambers at the first true-leaf stage and grown at two temperature regimes: 24°C day and 21°C night (positive DIF) and 21°C day and 21°C night (zero DIF) until plants reached the transplant stage. Plant height, leaf number and dry weight were reduced at 21°C day and 21°C night. Stem diameter was not affected.

DRIS (Diagnostic Recommendation Integration System) nutrient analysis of greenhouse cucumbers

Twenty-two southern Alberta growers provided cucumber leaf samples, growing media, and nutrient solution samples on a biweekly basis from March to July. Samples were analyzed for all nutrients by the Alberta Agriculture Soils and Animal Nutrition Lab, Edmonton. Results will be analyzed according to DRIS.

Floriculture Crops

Evaluation of poinsettia pinching methods

Three pinching methods were evaluated on three poinsettia cultivars, Lilo, Subjibi and Celebrate 2. Plants were given either a hard pinch (removal of 2.0-2.5 cm of terminal growth, leaving six or seven leaves below the pinch), a soft pinch (removal of the apex and all leaves less than 2.0 cm long), or a soft pinch plus leaf removal (similar to

the soft pinch but immature leaves below the pinch are also removed). Plants were grown according to standard cultural practices. Plant height, the number of bracts, and the number of shoots were increased with a soft pinch or a soft pinch with leaf removal. Bract diameter was not affected, except with Subjibi, in which diameter was reduced with a soft pinch, or a soft pinch with leaf removal.

Cycocel/B-Nine tank mix applications for poinsettias

Poinsettias, cv. Dark Red Annette Hegg, were treated with various foliar combinations of Cycocel and B-Nine growth retardants. The treatments were 500 ppm Cycocel and 500 ppm B-Nine in one or two applications; 1000 ppm Cycocel and 1000 ppm B-Nine in one or two applications; 1500 ppm Cycocel and 1500 ppm B-Nine and one or two applications; 2000 ppm Cycocel and 2500 ppm B-Nine in one or two applications. The number of shoots was not affected. The greatest reductions in height and bract diameter were observed in the highest rate of Cycocel and B-Nine. A second application in any treatment did not reduce height or bract diameter.

Production of poinsettias on an ebb and flood bench system

Poinsettias, cv. Dark Red Annette Hegg, were grown in 15-cm pots at three fertilizer rates (100 ppm N, 150 ppm N and 200 ppm N from water soluble 17-5-19) in a non-replicated ebb-and-flood bench system. There was a reduction in the bract diameter at the lowest fertilizer rate. The electrical conductivity (EC) was measured in the lower and upper portions of the pots at flowering. The EC in the upper portion was increased three times at 150 and 200 ppm N, and two and two and a half times at 150 and 200 ppm N, respectively.

Effect of mycorrhizal fungi on the growth and flower production of greenhouse chrysanthemums, asters and marigolds

A cooperative trial was conducted with J.P. Tewari, Department of Plant Science, University of Alberta, and the ASCHRC Plant Pathology Staff. Refer to the Plant Pathology Program report for further details.

Production of torenia potted plants

Seedlings of Torenia cv. Clown Mix were planted at various seedling densities in 10- and 15-cm pots. The densities were one seedling per pot in 10-cm pots and three or five seedlings per pot in 15-cm pots. Within each treatment, plants were either unpinched, pinched once or pinched twice. Plant diameter was not affected by seedling density but was reduced by pinching. The number of shoots was greater with two

pinches but was reduced with one pinch. In all treatments, there was a general lack of uniformity among plants.

Lisianthus Cut Flower Trials

Three cultivars of the Heidi series of Lisianthus, Deep Blue, Pastel Blue, and Rose Pink, were propagated and grown for 1992 cut flower trials.

Extension

A large component of the 1991 Greenhouse Crops Program involved extension to southern Alberta greenhouse growers. This consisted of about three days each week for greenhouse visits, and one day for office calls and correspondence.

The greenhouse specialist was an associate director of the Alberta Greenhouse Growers Association (AGGA), secretary of the Protected Crops Advisory Committee, and coordinator of the Alberta Horticultural Congress Tour Committee. The AGGA Industry Survey was completed and assistance was provided to Economic Services Division Staff in conducting surveys. The greenhouse specialist also assisted the AGGA and Flowers Canada in developing the Protected Horticulture Crops Cooperative by conducting industry surveys.

The greenhouse specialist travelled to Holland in April to gain insight into the latest developments in technology and research, and presented her findings at the Alberta Horticultural Congress and to Red Hat Co-op members.

SPECIAL CROPS AND AGRONOMY SECTION

This section conducts applied research and provides extension and development services for special crops such as pulse crops, field corn, herb and spice crops, sunflower, and other new crops for the primary purpose of crop diversification. The section is also responsible for forage, cereal and oilseed cultivar testing and forage agronomy. The relationship of water and soil management to crop productivity is also researched. Research and extension projects are conducted cooperatively with other agencies. Most of the field trials are conducted on the Macleod Farm at Brooks, at the substation at Bow Island, and in farmers' fields at Rolling Hills, Standard, Acadia Valley, Milk River, Carmangay, Millicent, Hanna, and Bow Island.

Section Administration and Special Crops

Refe Gaudiel, B.S.A., M.Sc., Ph.D. ..... Section Head & Research Agronomist
Collin Wildschut, Dipl. Hort. ..... Technologist
Elizabeth Russell, Dipl. Hort. ..... Technologist (seasonal)
Pat Moskaluk ..... Secretary

Field Crops

Henry G. Najda, B.Sc., M.Sc., P.Ag. ..... Research Agronomist
Art Kruger ..... Technologist

Soil and Water Agronomy

R. Colin McKenzie, B.S.A., M.Sc., Ph.D., P.Ag. ..... Research Agronomist
Neil Clark, Dipl. RRT ..... Technologist
Shelley Woods, B.Sc. ..... Technologist (Seasonal)

SPECIAL CROPS PROGRAM

Program Leader: R. Gaudiel
Technologist: C. Wildschut
Seasonal Technologist: L. Russell

The Special Crops Program is responsible for applied research, extension, and development on alternative crops and crops new to Alberta. The program also provides service as consultants to other departmental staff and commodity organizations, and through cooperative tests and demonstration plots.

Detailed project results are presented in the ASCHRC pamphlet 92-20, *Special Crops Cultivar Trials*.

Research Projects

Evaluation of Cultivars and Cultural Practices for Drybeans

Several screening and yield tests were conducted at the ASCHRC and Bow Island Substation under irrigated conditions to evaluate the performance of various cultivars, selections, and breeding lines of drybeans for preliminary selection and for varietal registration and recommendation. A number of lines were earlier, higher yielding, and more upright than the standard cultivars. In 1991, one cultivar was recommended and approved for full registration and one for interim registration. There are currently at least three new promising cultivars of the black, pinto, and Great Northern types that can be registered.

Several cultivars of upright drybeans were again grown in narrow rows and high populations to evaluate their feasibility for direct harvest. Although not yet of the ideal plant type, there are certain cultivars that have the potential for high density planting and direct harvesting.

The bean crop modelling study, as part of an international cooperative project, was continued in order to develop a computer model that predicts growth, development, and yield in relation to various environmental parameters. Phenological traits and the agronomic and growth characteristics of seven bean cultivars were observed during the growing season, and the environmental conditions under which the test was conducted were recorded. The initial validation of the model by the data compiled in all sites in the last two years was promising and showed the potential application of the model for breeding and cultivar development programs.

Evaluation of Cultivars and Cultural Practices of Other Pulse Crops

Cultivars and breeding lines of fieldpeas, lentils, fababeans, soybeans, lathyrus, lupins, and chickpeas, were again evaluated for adaptability and performance at the ASCHRC, Bow Island Substation, and Standard field plots.

The fieldpea observational and cooperative tests, used for preliminary screening and for registration, respectively, showed a number of promising breeding lines and foreign cultivars. Most of the promising entries were European cultivars that were

semi-leafless, erect in growth habit, early maturing, and as high or higher yielding than the standard cultivars. The regional tests, in cooperation with other agencies, were conducted in 11 locations in Alberta. The tests have provided information on the adaptability and performance of registered fieldpea cultivars in different regions of Alberta, and the results are being used for cultivar recommendations.

The fieldpea seeding date trial of four cultivars was continued. Generally, early seeded plants yield more than those plants seeded late; however, the degree of response differed according to variety. A plant population trial consisting of four pea cultivars was conducted under different soil moisture levels using a "line source" irrigation technique. The fieldpea cultivars showed a greater response to different levels of soil moisture than to the different plant populations.

The promising lentil line 'selection 8,' which was similar in size to the common Chilean, continued to be among the top yielders. It is available for registration and will compete directly in the market that is predominantly supplied by the United States. Lentil lines low in tannin yielded poorly.

Evaluation of fababean cultivars, selections, and breeding lines continued at the ASCHRC and the Bow Island Substation in 1991. Certain determinate fababean cultivars from Europe continued to yield as high and were as early as the standard cultivars.

Although natto-type (small seeds for sprouting) soybean lines that were evaluated at Bow Island matured, plant architecture and yield was not as good as the standard cultivars. The low neuro-toxin lathyrus and the white sweet lupin lines tested at the ASCHRC and the Bow Island Substation again reached maturity and are potential grain legume crops for the Prairies. The 'desi' type (small, irregular, dark-coloured seeds used for flour) chickpeas continued to show better adaptability and yield than the 'Kabuli' types (large, cream coloured seeds used in salads).

Evaluation of Cultivars and Cultural Practices of Other Special Crops

Cultivars and lines of safflower, canary seed, millet, fenugreek, quinoa, grain amaranth, buckwheat, and hybrid sunflowers were evaluated at the ASCHRC, the Bow Island Substation, and the Standard and Acadia Valley field plots. No new safflower, canaryseed, or millet lines were found to be outstanding compared with the standard cultivars. The irrigated confectionery sunflower test at Bow Island showed the standard hybrid D131 and the newer hybrids D151 and IS8004 to be among the better hybrids in yield, percentage of large seed and stripe colour. The quinoa selections C0407 and C0407-12 continued to be the ones most adapted to Alberta. There were several selections of grain amaranth that appeared to be better suited to Alberta than quinoa.

The buckwheat lines tested at Brooks under irrigation gave good yields and reached maturity.

Adaptability, Cultivar Evaluation, and Agronomic Studies of Herb and Spice Crops

In 1991, the Farming for the Future funding made it possible to conduct trials with this group of crops for the purpose of determining adaptability, yield and quality, and commercial feasibility in Alberta. A large number of the trials were conducted in small experimental plots at the ASCHRC, but several trials were conducted with large (one acre or more) test fields at the ASCHRC, the Bow Island Substation, and Carmangay field plots. This allowed evaluation of these crops on a semi-commercial scale using conventional field equipment and the commercial distillation unit. A clevenger-type laboratory glass hydrodistillation unit was used to extract the essential oil from small samples. A 100-L stainless steel steam distillation unit was used for samples up to 25 kg.

These results indicated which crops are adapted to Alberta and some of the basic agronomic practices necessary for the commercial production of them. Potential essential oil yield and quality of several crops were obtained. Preliminary determinations have been made of the freezing tolerance and overwintering characteristics of mints and monardas. Also determined were several important processing procedures and factors necessary for efficiently distilling the crops. Several selections of basil were identified to have high methyl cinnamate content in their essential oil. Tests for genetic variability found some of these plant populations to be relatively stable. Screening tests have identified unique and promising lines of monarda, fenugreek, and coriander. The semi-commercial field tests have produced enough essential oil for test marketing and have helped to develop the commercial production of essential oil crops in Alberta. Commercial production of essential oils in Alberta commenced in 1991.

Corn Hybrid Trials

Grain and silage corn hybrids were again tested at the ASCHRC and Bow Island Substation as part of the Alberta Corn Hybrid Testing Program sponsored by the Alberta Corn Committee. Results of these tests plus those conducted at Lethbridge and Medicine Hat by Agriculture Canada, Lethbridge, are used to recommend hybrids for registration and to make recommendations to Alberta growers. Forage and grain sorghum hybrids were also evaluated at the ASCHRC and Bow Island Substation.

Detailed results are presented in the Alberta Corn Committee publication *Hybrid Trials - 1991*.

All of the corn hybrids reached maturity because of long, favourable, dry weather from early August until a killing frost late in September. Several grain corn hybrids were as early and higher yielding than the standard hybrids. The irrigated forage sorghums yielded as high as the forage corn hybrids at Brooks and Bow Island. Some of the new grain sorghums, although seeded late, still managed to reach maturity. A few of the grain sorghum hybrids looked promising and will be evaluated again in 1992.

FIELD CROPS PROGRAM

Program Leader: H. Najda
Technologist: A. Kruger

The Field Crops Program conducts research to provide up-to-date information on traditional cereal, oilseed, and forage crops. Alternate uses of these crops, such as annual forage, plowdown, reclamation and seed production are also investigated as possible cropping options.

Four major areas of research involving over 100 trials were conducted in southern Alberta. The main testing site is at the ASCHRC; other main sites are located at the Bow Island Substation, the Standard field plots, and at farmers' test sites at Milk River and Millicent. These are all irrigated sites.

Several trials were conducted in cooperation with other research institutions and agencies. These include the Agriculture Canada Research Station, Swift Current (triticale co-op), and the Field Crops Branch, Alberta Agriculture, Lacombe (cereals, oilseeds and forages). We assist the Chinook Applied Research Association in cereal, forage, and special crops research. New crop varieties are also tested for universities and research agencies in Canada and abroad.

The field crops specialist provides service to other Alberta Agriculture staff and to producer and commodity organizations. Details of all research trials are presented in *Field Crops Cultural and Cultivar Trials, 1991*, ASCHRC Pamphlet 92-9.

Research Projects

Cereal and Oilseed Cultivar Evaluation

Cereal and Oilseed Regional Tests

Trials coordinated by the Field Crops Branch, Alberta Agriculture, Lacombe, are used to evaluate all currently used cultivars, new cultivars, and breeding lines of hard red spring wheat, durum wheat, utility wheat, barley, oats, triticale, flax, and canola. Staff are responsible for the three irrigated sites at the ASCHRC, the Bow Island Substation, and the Standard field plots. Information from these trials, conducted at more than 30 sites province-wide, is used by the Cereal and Oilseed Advisory Committee to annually update the factsheet *Varieties of Cereal and Oilseed Crops for Alberta*. Some new cultivars added to the list for 1992 include Cutler wheat, Creme 6-row barley and Stein 2-row barley. Three oat varieties were deleted from the test: Harmon, Riel, and Tibor.

Other Cereal Trials

The ASCHRC cooperates with the Field Crops Branch in their breeding programs for 2-row and 6-row barley, triticale, winter triticale, and winter wheat. The progeny and advanced line tests provide agronomic data that are used in the selection process for determining new varieties suitable for irrigated areas. Triticale grain trials are conducted under the Prairie Registration Recommending Committee on Grain Testing Program, which is coordinated by the Agriculture Canada Research Station, Swift Current, Saskatchewan.

Annual Forage Crop Studies

Silage trials

In 1991, several cultivar trials were conducted on annual forages used as silage. These included barley, oats, utility wheat, triticale, field pea, and fababeans. This was the fifth year of testing and the results will provide a database on variety performance.

In the 6-row barley silage test, Heartland had the highest yield at 16.6 t/ha, which was 3% higher than the check variety Galt. Samson, a semi-dwarf variety, had the highest protein level at 16.6%. Of the two-row barleys tested in 1991, the experimental line TR 117 was the highest yielding at 15.8 t/ha. Over the long term Stein and Bridge have had the highest yields which were 6% over the check variety Galt. Fielder utility wheat and Wapiti triticale have consistently been the highest producers and were once again in 1991. In the oat trial, Jasper had the highest yield of 14.9 t/ha; however the

long term average has the forage oat Foothill at the top by 5% over the check variety Cascade. Titan fieldpea and Aladin fababean have been the top producers in their respective tests over the past five years.

Cultural studies

Continued research on annual forages evaluated the potential of foreign legumes for forage, plowdown and/or reclamation use. Several species from the U.S.A. and Australia show promise. They grow well in saline areas and yields for some species have been over 10 t/ha. Also, an experiment to determine the effect of seeding depth and date on sorghum-sudangrass was initiated at the ASCHRC and the Bow Island Substation.

Perennial Forage Crop Studies

Perennial forage variety testing

This was the first production year of a province-wide program evaluating perennial forage varieties including alfalfa, sainfoin, the wheatgrasses, and bromegrass. The Field Crops Program is responsible for conducting trials at two dryland (Bow Island Substation and Standard field plots) and two irrigated (Bow Island Substation and the ASCHRC) sites and for compiling and analyzing data from all sites, and preparing the annual report. This program was initiated to provide data that would allow producers to select from the newest forage varieties available. Data from this year's harvests have indicated that there are significant differences in variety performance from one area of the province to another. Results of the trials will be made available after three production years.

Perennial forage seed production

This area of research has increased as U.S. companies consider contract production in southern Alberta. A cooperative trial with R. C. McKenzie, ASCHRC Soil and Water Specialist, and K. Miller, Milk River, continued to investigate the effect of various fertilizer rates on tall fescue and Kentucky bluegrass seed production. As well, adaptability trials on Kentucky bluegrass, tall fescue, and fine leaved fescue were seeded at the ASCHRC and Bow Island with a third site to be established at Milk River.

Extension and Service Activities

Presentations were made at one scientific conference, several industry and producer meetings, and provincial advisory committees. Two information sheets on annual forage species were written.

The program leader sits on the Alberta Forage Variety Committee, the Cereal and Oilseed Testing Committee, and the Agriculture Technology Advisory Committee of the Lethbridge Community College. He serves annually as a seed judge for the North American Seed Fair held at Ag-Expo, Lethbridge.

SOIL AND WATER AGRONOMY PROGRAM

Program Leader: R. C. McKenzie
Technologist: N. F. Clark

Research is directed to crop production areas where new developments are taking place and where knowledge and skills of the soil and water staff can be anticipated to make an impact. Some projects are done co-operatively with staff at the ASCHRC and the Alberta Agriculture Soils Branch, Edmonton. Laboratory analyses for some projects is provided by the Alberta Agriculture Soils and Animal Nutrition Laboratory, Edmonton. Farmers and greenhouse growers provided crop samples and pertinent production information. Funds to carry out research were provided by Farming for the Future (FFF) and the Alberta Corn Committee.

Research Projects

Irrigation Management of Lentils

Two lentil cultivars, Eston (early maturing, small-seeded) and Laird (late maturing, large-seeded), were grown under four irrigation treatments for five years. Laird is a variety with indeterminate growth and when ample water is available it continues to grow vegetatively and fails to set seed. Laird showed an appreciable decline in yield when water use was higher than optimum (200-270 mm). Eston, a variety with determinate growth, did not respond significantly to varying amounts of irrigation. Maximum yields of Eston were obtained with 250-350 mm of water.

The depth at which the roots of lentils effectively drew the water out of the soil was measured on plot sites that received little or no irrigation. The proportion of available

soil moisture that was present in the spring and used up by fall was 72, 91, 45, and 14% for the 0-30, 30-60, 60-90, and 90-120 cm layers, respectively. This means a rooting depth of 0.75 m can be used for scheduling irrigation.

Irrigation Management of Safflower

A water use experiment with safflower has been conducted for four years. In 1991, the experiment with four irrigation treatments and three rates of nitrogen fertilizer was conducted with Saffire safflower at the Bow Island Substation. Rainfall was above normal in 1991 (163 mm) and with depletion of available soil moisture (232 mm on the no irrigation treatment) it supplied sufficient moisture for the crop; therefore, irrigation did not increase yields.

Extraction of available soil moisture by the safflower was increased on the treatments that had high rates of nitrogen. Safflower was able to deplete all of the available soil moisture to 1.20 m and about half of the available moisture from 1.20 to 1.50 m. Yields and water data for four years indicate that increasing amounts of irrigation increased the yield of safflower seed only until it brought the total water use up to 380-460 mm. Over the same four years quality, as measured by protein and oil contents of seed, declined with increasing amounts of irrigation.

Line Source Irrigation of Monarda

A plot consisting of rooted cuttings of monarda was planted in July, 1990. In 1991, it was irrigated and missing plants were replaced. In 1992, two levels of nitrogen will be applied and replicated, and a series of water treatments will be applied with a line source system. Plants will be harvested, and oil yield and quality will be measured.

The Effect of Irrigation Management and Frequency of Harvest on Yield and Quality of Two Types of Alfalfa

Increasing the harvests from two to three or four annually significantly increased both yield and protein content of alfalfa hay. However, the treatments that were harvested three or four times had more damage due to winterkilling than the treatment that was harvested only twice. The additional costs and labour required for more frequent harvests and more irrigation may be justified if the hay is produced for an export market or for dairy cattle. An export market demands high quality alfalfa hay that has a high protein content. More research is needed to determine the optimum timing of harvesting and irrigation to obtain maximum yields of high quality forage and maintain a low risk of winterkilling.

In 1992, a new plot will be established because winterkilling has reduced the stand at the present site.

Salinity and Cold Tolerance of 28 Species of Ornamental Trees and Shrubs

The project, funded by FFF, was initiated in 1989 jointly by the Soil and Water Agronomy and Nursery Crops and Ornamentals Programs to evaluate both salinity and cold tolerance of a number of species of trees and shrubs. Twenty-eight species and varieties of trees and shrubs were replicated six or ten times in each of five salinity zones ranging from low to high. The 15 varieties that were replicated ten times will also be used for cold tolerance evaluation.

Statistical analyses have been performed on the data from only the third growing season (1991). Growth, normalized growth, and survival have been compared to soil salinity between 0.00 and 0.60 m depth. Growth is calculated using three measurements for each tree. Normalized growth gives an indication of a variety's salinity tolerance, and survival indicates a variety's hardiness and ease of establishment. These results have been summarized to produce a ranking of overall growth, salinity tolerance, and survival. Russian olive has the highest overall ranking. A field trial with a large number of species and replications is feasible because salinity data can be collected efficiently at a low cost using an EM38 salinity meter in conjunction with a portable computer.

S. Woods, who has worked on this project for the last three summers, will be using data from this project for her thesis at the Faculty of Environmental Design, University of Calgary. Her topic is "Urban and rural applications for the salinity tolerance of ornamental trees and shrubs in southern Alberta."

Preliminary cold tolerance evaluation was conducted for five species by the Nursery Crops and Ornamentals staff. More species will be evaluated for cold tolerance in 1992 as the trees become larger and more material is available to take woody cuttings.

Salinity Tolerance of Forage and Turfgrasses

A project to measure the salinity tolerance of forage and turf grasses was carried out jointly with the Field Crops Program. In 1990, species of both forage and turfgrasses were planted near Brooks under irrigated conditions and at Hanna and Oyen test sites that did not receive irrigation. At Oyen, because of drought, it was necessary to replant the site in 1991.

At the Brooks test site, Dahurian rye grass had the highest total yields (11.1 t/ha) on the first and second harvest on the most saline sites. Tall wheatgrass, a conventional high yielding salt-tolerant grass, yielded second highest at 10.3 t/ha. This was considerably higher than grasses such as Fairway crested wheatgrass, which yielded 6.8 t/ha, or smooth bromegrass at 6.3 t/ha. Kentucky bluegrass was the least salt tolerant of the all the grasses tested. In the most saline zone the following three turfgrasses, Kentucky bluegrass, creeping bentgrass, and creeping red fescue yielded 0.2, 2.9, and 3.5 t/ha respectively. The differences in salt tolerance of these grasses is not known yet in the turfgrass industry.

A number of tours have visited the Brooks and Hanna test sites and the project has attracted interest from grass seed producers, farmers, landscapers, and extension staff. A new salt-tolerant grass like Dahurian wildrye should have a niche as a short-lived, high quality grass. Some of the tall fescues or creeping red fescue could be used in the turf industry where salinity problems occur.

Effect of Rates and Timing of Nitrogen on Seed Production of Kentucky Bluegrass and Tall Fescue

This is a joint project with H. Najda, the Field Crops Specialist, and K. Miller, a grass seed producer at Milk River. The project was started in 1989 with support from the federal New Crop Development Fund. Treatments consisted of three rates of nitrogen applied in the fall and in the spring and an unfertilized control. In 1991, silver tip severely reduced yields of Kentucky bluegrass.

The Effect of Gypsum and Rates and Timing of Nitrogen on Seed Production of Kentucky Bluegrass on a Sodic Soil

The effect of both nitrogen fertilizer and gypsum will be measured on the yield of Kentucky bluegrass seed when it is grown on a sodic soil. This type of sodic soil occurs on about 3000 acres of soil that are irrigated with high sodium waters from Verdigris Coulee. The project commenced in the fall of 1991 in co-operation with K. Miller, Milk River. This is a FFF Region I demonstration that is funded for three years.

Evaluation of Climatic Factors on Forage Production

This project is operated by D. Westerland and A. Lowther from the Chinook Applied Research Association. Assistance with soil sampling and data interpretation is provided by the soil and water agronomy staff. The project commenced in 1989 for five years with support from the Alberta Agriculture Research Institute Matching Grants Program.

DRIS (Diagnostic Recommendation Integrated System) Analysis of Forage Alfalfa Corn and Greenhouse Cucumbers

There is increasing interest among agronomists in using tissue testing to diagnose plant nutrient deficiencies and for optimization of fertilizer applications. DRIS was developed in South Africa and the southern U.S.A. and is suitable for use with intensively managed crops. It is a new method of tissue analysis that uses nutrient ratios rather than nutrient sufficiency levels to determine nutrient deficiencies. This is a joint project with J. Butt, ASCHRC Greenhouse Specialist, L. Kryzanowski, Crop Nutrition Specialist, Soils Branch, and D. Heaney, Soil Scientist, Alberta Agriculture Soils and Animal Nutrition Lab.

The aims of the project are to:

- Collect a data base to develop DRIS standards for the three crops under conditions in Western Canada.
- Survey the three crops and identify nutritional problems.

There were 23, 10, and 22 alfalfa fields sampled in 1989, 1990, and 1991, respectively. In 1990, 16 and in 1991, 18 greenhouse cucumber operations were sampled on a biweekly basis. Both grain and silage corn fields were sampled (20 in 1990 and 29 in 1991).

Phosphorus was deficient in both soil and tissue samples from about one third of the alfalfa fields in 1989, 1990, and 1991. In 1989, potassium was deficient in tissue samples from about one third of the alfalfa fields but it was not deficient on soils of the same fields. In 1991, tissue potassium was deficient and soil potassium was marginal on some fields. No trends of nutrient deficiencies were evident on the 1990 corn and greenhouse cucumber samples.

In 1991, financial support was provided by the Alberta Corn Committee. For 1992, support for a matching grants proposal has been offered by the Alberta Corn Committee, the Potash and Phosphate Institute of Canada, and Lakeside Research.

Extension and Information Transfer

Soil and water information was provided to a diverse audience through technical reports, production manuals, and research publications. Presentations were made at producer meetings and inquiries were answered through telephone contacts, office visits and correspondence. Alberta Agriculture staff, agriculture fieldmen, and consultants have had their EM38 salinity meters calibrated and adjusted by the Soil and Water Agronomy Staff.

CROP PROTECTION AND UTILIZATION SECTION

This section operates research, extension and service programs in plant pathology, entomology, weed science, plant diagnostics, post-harvest technology, and food science. Support is provided to crop production research programs at the ASCHRC and to agricultural industries and individual producers in Alberta. Crop pest surveys and diagnoses, pesticide efficacy testing, evaluation of crop storage practices, and modified atmosphere packaging of food products are examples of some of the projects carried out. Research and extension programs are conducted in cooperation with other ASCHRC staff and with federal, provincial and university scientists. Close working contacts are maintained with various agricultural and scientific organizations outside of Alberta.

Section Administration and Plant Pathology

Ronald J. Howard, B.S.A., M.Sc., Ph.D., P.Ag. ..... Section Head and Plant Pathologist
Karen Chapman ..... Section Secretary
Edward Moskaluk ..... Laboratory Technician

Food Science

Janet A. Panford, B.S.A., M.Sc., Ph.D. ..... Food Scientist
Margaret Dench ..... Culinary Laboratory Technician
Joseph Hung, B.Sc. ..... Analytical Laboratory Technician

Field and Special Crops Entomology - Crop Protection Branch, Edmonton

Jim Jones, B.Sc., M.Sc. ..... Entomologist

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Weed Science

Rudolph Esau, B.S.A., M.Sc., P.Ag. ..... Weed Scientist
Bernice Kruger, Dipl. Agr. ..... Technologist

PLANT PATHOLOGY PROGRAM

Program Leader: R. Howard
Technician: E. Moskaluk

The Plant Pathology Program has a mandate to conduct applied research on important diseases of special crops, horticultural crops, and selected cereal, oilseed and forage crops. These studies encompass field, laboratory, growth chamber and greenhouse experiments, as well as disease surveys. Findings from this work and from the research of other scientists are presented to producers through extension programs. Service is another activity that primarily involves support to the Regional Crop Laboratory. Some plant pathology projects are also discussed in the report of the Post-Harvest Program in this report. A summary of Plant Pathology Program activities in 1991 is given below. Further details of all research trials appear in the *Plant Pathology Program Research Report - 1991*, ASCHRC Pamphlet 92-10.

Research Projects

Diseases of Special Crops

Efficacy of seed treatments against seed decay and seedling blight of safflower

Thiram 75% WP (PCP #15933) was registered for use as a seed treatment on safflower under the Minor Use of Pesticides Program in 1991. Further studies of Thiram 75% WP and Vitavax Dual Powder 68% DU were carried out in growth chambers in 1991. These fungicides were applied at rates exceeding the label recommendations to determine efficacy and potential phytotoxicity. Seed of Saffire and a newly registered cultivar, Stirling, was treated with each product and sown into infested soil. Fungicidal seed treatment significantly improved the emergence of both cultivars and neither chemical appeared to have a phytotoxic effect at rates up to 1½ times the normal dosage.

Efficacy of two fungicides against powdery mildew on monarda

Two sulphur-containing fungicides were evaluated for their ability to control powdery mildew (*Erysiphe cichoracearum*) on monarda in a field trial. Micro-Niasul W 92% WP (4.0 kg/ha) and Microthiol Special 80% WP (4.5 kg/ha) were applied to replicated subplots. Other subplots were sprayed with tap water as a check. The plants were about 30 cm tall on June 13 when the first sprays were applied, and symptoms of mildew infection were just beginning to show. Only one rate of each fungicide was used, but the timing of application was varied to accommodate three treatments: June 13 only, June 13 and July 3, and July 3 only. Mildew incidence was visually rated from

July 22 to 24. Both fungicides provided good control of powdery mildew relative to the check. The two-application regime was more effective than either single spray. Micro-Niasul and Microthiol did not significantly differ in efficacy. Essential oil yield from subsamples of Microthiol-treated monarda averaged 38% more than the control. The percent geraniol in the oil from the treated plants exceeded that of the check ones by nearly 2%.

Trial results were published in the *1991 Pest Management Research Report - Insects and Diseases* of the Expert Committee on Pest Management, Agriculture Canada, Ottawa.

Screening dry beans for resistance to fusarium root rot

Thirty-nine named cultivars and breeding lines comprising the Prairie Dry Bean Co-op Trial were screened for resistance to *Fusarium oxysporum*, the cause of root rot disease. This is a cooperative project with G. Saindon, Agriculture Canada, Lethbridge. The bean seed was planted into artificially infested soil in a replicated greenhouse trial. Percentage seedling emergence and root rot severity were measured for each cultivar. Although significant differences in emergence occurred between some cultivars, it is doubtful that they reflected variations in disease resistance because the germination of several entries was inherently low. No significant differences in root rot severity occurred among the cultivars and lines under test, probably because disease ratings across the experiment averaged "slight" and may have been too low to detect significant variances in resistance.

Diseases of Forage Crops

Identification and pathogenicity of fungi and bacteria from forage grasses

Fungal and bacterial isolates obtained from forage grasses sampled during disease surveys in 1989 and 1990 were purified and sent to the Alberta Environmental Centre, Vegreville (bacteria) and the C.A.B. International Mycological Institute, Surrey, England (fungi) for identification. These isolates were also artificially inoculated onto their original hosts to determine if they were capable of inciting disease. Over 36 species of bacteria and fungi were identified, and several proved to be pathogenic in inoculation trials. This study is continuing.

Thermal inactivation of *Verticillium albo-atrum* in infected alfalfa stems

Alfalfa stems infected with *Verticillium albo-atrum*, the cause of Verticillium wilt disease, were subjected to temperatures ranging from 35 to 85°C for varying periods of time to determine the time/temperature combination that would eradicate the

fungus. This trial was undertaken to fill in data gaps from previous experiments and to provide information that would be helpful in interpreting the results of trials at a commercial alfalfa dehydration plant in Vauxhall. This study is ongoing.

Effect of commercial dehydration on the survival of *Verticillium albo-atrum* in infected alfalfa

This was a cooperative trial with ADCO Ltd., a Vauxhall-based commercial alfalfa dehydrating plant. Samples of fresh and dried material were taken at all stages of the dehydration process as a load of Verticillium wilt infected alfalfa hay was being processed. Results indicated that pelleting of the freshly cut alfalfa virtually eliminated the pathogen from the finished product. Wherever it survived, *Verticillium albo-atrum* retained its pathogenicity to alfalfa plants as determined by artificial inoculation tests conducted in a growth chamber.

Diseases of Fruit Crops

Evaluation of ten saskatoon cultivars for resistance to powdery mildew

An orchard of 8- to 14-year-old saskatoon bushes were visually rated for incidence of powdery mildew (*Podosphaera clandestina*) from July 17 to 18, 1991. The percentage of mildewed leaves and berries was measured on each of ten cultivars in the four replicates comprising the trial. Mildew was found on every bush in the orchard, but its incidence on individual cultivars was variable. It was more severe at the tips of branches and on the north side of the bushes. Mildew incidence was higher on the foliage than on the fruit. Parkhill, Success and Forestburg had the highest percentage of mildewed leaves and berries. Moonlake, Honeywood, Thiessen and Regent exhibited significantly less foliar mildew than the other six cultivars. Moonlake, Honeywood, Thiessen, Smoky and Pembina had significantly fewer mildewed berries than did Northline, Forestburg, Success, Regent and Parkhill. Overall, Parkhill and Success had the least and Honeywood, Thiessen and Moonlake the best powdery mildew resistance.

These survey results were published in the 1992 Disease Highlights Edition of the *Canadian Plant Disease Survey*, Agriculture Canada, Ottawa.

Diseases of Greenhouse Crops Project

Effect of mycorrhizal inoculation on the growth and flower production of greenhouse chrysanthemums

In a cooperative trial with J.P. Tewari, Department of Plant Science, University of Alberta, Edmonton, and the ASCHRC Greenhouse Program staff, three vesicular-

arbuscular mycorrhizal (VAM) species were evaluated for their effect on growth and flower production of pot mums. The cultivars Charm and Yellow Envy were inoculated with *Glomus mosseae, G. dimorphicum* and *G. intraradices* at the rooting stage, and at maturity the plants were assessed for flower production and plant quality compared with uninoculated controls. Two different fertilizer treatments were also superimposed on the trial. Mycorrhizal inoculation generally had very little effect on growth and flowering except for reduced dry weight in Yellow Envy and reduced height in Charm.

Effect of mycorrhizal inoculation on the growth and flower production of aster and marigolds

In a similar trial to the one discussed above, two cultivars each of asters and marigolds were inoculated with the three mycorrhizal species and transplanted into field plots. Measurements of flower production and plant size were taken in summer. No significant differences were observed between the VAM and control treatments for any of the growth measurements in the marigolds. In the asters, however, the height and dry weight of one of the cultivars was significantly reduced by VAM inoculation.

Extension and Service Activities

The program leader spoke at several growers' meetings and workshops and was active in several professional societies and advisory committees. Regular contributions were made to the ASCHRC's *Crop Protection Newsletter*. Two scientific papers and a number of miscellaneous publications were prepared by program staff.

Considerable time was spent editing and writing material for the book *Diseases and Pests of Vegetable Crops in Canada*, a joint publication of the Canadian Phytopathological Society and the Entomological Society of Canada. It will be published in 1992.

The Fungicide and Fumigant Information Retrieval System, a microcomputer-based program for searching fungicide and fumigant labels, was upgraded to Version 5.0. Staff of the Pesticides Directorate, Agriculture Canada, Ottawa, provided updates of the fungicide and fumigant label database for use with the program.

Diagnostic assistance was provided to the Regional Crop Laboratory. As well, advice on disease identification and management was given to the ASCHRC staff as requested.

The program leader retained an appointment as an Adjunct Professor in the Department of Plant Science, University of Alberta. Involvement in departmental activities included lecturing, diagnostic consultations and cooperative research.

FOOD SCIENCE PROGRAM

Program Leader: J. Panford
Technicians: J. Hung (analytical lab) and M. Dench (culinary lab)

The Food Science Program has three major areas of responsibility:

- applied research is conducted on horticultural and special crops.
- extension and technical information is provided to processors of horticultural and special crops.
- a service component is devoted to support other production-oriented research programs at the ASCHRC.

Research Projects

Modified Atmosphere Packaging of Vegetable Crops

Modified atmosphere packaging (MAP) technology was applied to the storage of fresh broccoli, field cucumber cv. Slicer, and green and yellow bell peppers. The vegetables were packaged whole in two types of polyethylene, Fresh Hold® (FH) and polyethylene (PE) films (bags) and flushed with a gas mixture (5% $C0_2$; 5% 0_2, 90% N_2). Packaging was done within 24 h of harvest.

Results indicated that MAP-packaged cucumbers stored better and longer at room temperature (22°C) than with refrigeration (5°C). The reverse was observed in broccoli, which stored better and longer with refrigeration than at room temperature. Green peppers remained fresh, firm and acceptable longer than yellow bell peppers under all test conditions. The ability to withstand altered gas mixtures was dependent on crop type and variety. There was no significant difference between performance of the FH and PE films. Both exhibited appreciable condensation in the bags one week after packaging and throughout storage.

Further research will be conducted to determine the respiration rate of these crops and the permeability rates of the films.

Evaluation of Saskatoon Berry Flavour

Five cultivars of saskatoons (Honeywood, Northline, Pembina, Smoky, Thiessen) were hand-harvested and the flavour evaluated by a trained panel. Results indicated that flavour of the freshly harvested berries was superior and preferred to that of

chilled (5°C) berries. All cultivars retained their colour after harvest and when frozen (-22°C). Freezing berries within 24 h of harvest prevented significant losses in the natural flavour.

A storage trial of saskatoon berries harvested in 1989 was completed. Samples of ten cultivars frozen for 18 or 24 months were juiced and tested for pH, soluble solids (refractometer) and moisture content. The pH level increased by two to four units within the first six months of storage and remained constant through the study period. There were no significant changes in soluble solids and moisture content over the entire storage period.

Two trials were carried out to develop a raisin-type product from saskatoon berries. Further work is required to improve the product. Several recipes of saskatoon-rhubarb jam were tested and the finished products evaluated for flavour and consistency. Further improvements are necessary.

Monitoring Total Glycoalkaloid Content of Potatoes

Potato tubers cv. Connestoga were harvested at four to seven day intervals from three locations in southern Alberta over a period of 12 weeks (July-Sept/91). Samples were analyzed chemically for their total glycoalkaloid (TGA) content within 24 h of harvesting. TGA content decreased as the tubers matured. Decreases in TGA were also observed as the vegetative parts of the plants died off and the tuber skins set. Unpeeled samples contained 50% more TGA on average than peeled fractions. This indicated that most of the TGA was concentrated in the outer layers of the tuber. Sensory evaluation results showed that tubers containing more than 15 mg TGA/100 g fresh weight tasted bitter, gave a burning sensation in the mouth, and smelled earthy. This research is being continued and is supported, in part, by the Alberta Potato Research Association.

Value-Added Rhubarb Product Development

In collaboration with the ASCHRC Vegetable Program, the Food Processing Development Centre at Leduc, and B. Ooraikul, Department of Food Science, University of Alberta in Edmonton, we developed various rhubarb products. Seven cultivars of rhubarb, Early Sunrise, German Wine, MacDonald, Cherry Wine, Cherry Red, Canada Red and Crimson Red Cherry, were harvested and frozen in May-July, 1991. Samples of rhubarb marmalade, chutney, candied pieces and syrup were developed at the ASCHRC and were sent to Edmonton and Leduc for upgrading and/or modification to a commercial product. This work is being continued.

Service

Vegetable Crops

Thirteen cultivars of broccoli were evaluated organoleptically for their fresh quality (flavour, texture, appearance) attributes by a trained panel. Quality attributes differed among cultivars. Frozen samples will be evaluated after four and six months of storage.

Nine cultivars of fresh cauliflower were evaluated for flavour, texture and appearance by a trained panel. Again, quality attributes differed among cultivars. Frozen samples will be evaluated after four and six months storage.

Eighty cultivars of cabbage were analyzed after harvest for colour using a Hunter Lab colorimeter. The colour will be monitored after four and six months of cold storage.

Thirty-one tomato samples were analyzed for pH levels in 1991; the values ranged from 4.33 to 4.66.

Potatoes continued to account for a major portion (60%) of the workload in the culinary laboratory. Over six hundred samples were chipped, boiled, baked, or processed into French fries. All samples were evaluated for colour, texture and/or flavour. Seven selections from the Prairie Maincrop Replicated Trial were analyzed for their total glycoalkaloid content as well.

Fruit Crops

Fresh, chilled (5°C), and frozen (-22°C) berries of the 1991 crop, as well as the juice, were evaluated for flavour. Due to excessive rainfall the crop was heavily infested with powdery mildew. Consequently only five cultivars, Honeywood, Northline, Pembina, Smoky, and Thiessen, were harvested and evaluated for various quality attributes. These samples have been frozen pending sensory and chemical analyses after 6, 12, 18 and 24 months storage.

Previously-frozen raspberry samples (1990 crop) from ten summer-bearing cultivars, ten summer-bearing selections and two fall-bearing cultivars were evaluated for form and flavour in January, 1991. The 1991 crop was frozen and is currently being evaluated by a trained panel.

Fruit from 22 cultivars of June bearing and seven cultivars of day-neutral strawberries were frozen. They will be evaluated for form, texture and flavour.

Nine cultivars of previously frozen (1990 crop) Mongolian cherries were processed into jelly. Sensory evaluation results indicated a very good product. However, juice concentrate made from these cherries requires further work. The 1991 crop has been frozen and will be processed into jelly and juice at a later date.

Special Crops

Studies of essential oils continued to account for about 70% of the work carried out in the analytical laboratory. Forty-eight different herbs and spices (over 1,500 samples) were steam distilled and the oils collected. Oil samples were analyzed on a gas chromatograph and the major components identified on the basis of pure standards scanned along with the samples. However, several unidentified peaks still exist in most of these samples. These oils will be re-analyzed on the MS-GLC unit in the Foods Laboratory, Edmonton, to confirm all components.

Extension

The Food Science Program continued to provide technical information and assistance to horticultural crop producers, processors, district agriculturists, district home economists and the general public. Collaboration and cooperation with other government research centres, laboratories, universities and colleges have been increased.

Program staff attended seminars, workshops and professional meetings. Presentations were made at the Alberta Horticultural Congress and at the Potato Growers of Alberta annual meetings. Participation continued in the Alberta Potato Research Association, Alberta Potato Advisory Committee, the Canadian Institute of Food Science and Technology, the Institute of Food Technologists, and the American Oil Chemists Society.

Due to budget cuts, extension activities, particularly travel to processing plants, and meetings, were reduced. Increased use was made of telephone, mail, and facsimile media to accomplish the Program's extension mandate.

HORTICULTURAL ENTOMOLOGY PROGRAM

Leader: R. Esau
Technician: A. Tellier

The Horticultural Entomology Program conducts research and provides extension and diagnostic services. Research is directed toward major pest problems on selected horticultural crops. Extension assistance is given to Alberta's agricultural industry, to individual growers, and to Alberta Agriculture staff. Diagnostic services and pest control recommendations are provided to clients of the Regional Crop Laboratory and to the ASCHRC researchers.

Research Projects

Greenhouse Pest Management

Susceptibility of *Phytoseiulus persimilis* to four fungicides

In 1991, commercial greenhouse growers in Alberta again reported poor establishment of the predatory mite, *Phytoseiulus persimilis*. Staff assessed the susceptibility of *P. persimilis* to four fungicides commonly used in greenhouses. Predatory mites were obtained from the two major suppliers in Alberta and reared on cultures of the two-spotted spider mite, *Tetranychus urticae*, on bean plants. Only adult female predatory mites were used in the tests. The experiment was carried out using the slide dip test method with Benlate, Micro-Niasul, Rovral, and Benlate plus Manzate 200 at label rate, two and four times the recommended label rate.

P. persimilis from both suppliers took up to six weeks to establish. The highest mortality (63% at the 4x rate) occurred with Benlate and Benlate plus Manzate 200. Up to 28% mortality occurred with these same products applied at label rates. At 4x label rate with Rovral or Micro-Niasul, mortality never exceeded 10% Mortality differences in *P. persimilis* taken from the two suppliers were not significant. Sub-lethal effects were not assessed.

Monitoring Insect Pests of Saskatoon Fruit in Southern Alberta

The objectives of this study were:

1) to identify and quantify insect species that damage saskatoon fruit in southern Alberta,

2) to evaluate different sampling procedures for predicting insect infestations, and

3) to record the occurrence of insect pests in relation to stages of fruit development.

The use of various coloured sticky traps for pest monitoring has been well developed for a wide range of crops. The main target pests of saskatoon berries in 1991 were leafrollers; *Archips argyrospila* (fruitree leafroller), *Choristoneura rosaceana* (obliquebanded leafroller), sawflies, *Hoplocampa* spp., and the apple curculio, *Tachypterellus quadrigibbus*. One monitoring method employed both bright yellow and non-ultraviolet white sticky cards (10 cm x 15 cm) which were hung in the mid-canopy of saskatoon bushes. Twenty-five cards of each colour were placed in a 0.2-ha orchard. The traps were changed weekly for a period of four weeks and insect catches were recorded. A second method of monitoring involved collecting 50 fruit clusters at random within the same 0.2 ha orchard and from a native stand for comparison. Cluster sampling began shortly after petal drop and was continued weekly until harvest. This method was also used on the native stand of bushes growing sporadically in the Red Deer River valley.

The only insect pests attracted by the white cards were sawflies; as many as 50 adults were trapped on one card in a week. Yellow cards attracted only a very low percentage of sawflies. There was no correlation between sawfly catches and the number of berries damaged by these pests. Fruit cluster sampling at the ASCHRC at harvest time indicated an average of seven berries per cluster of which approximately two were scarred. The native stand at Emerson Bridge, north of the ASCHRC, had an average of five berries per cluster of which three were scarred. Scarring of the berries at the ASCHRC was primarily caused by leafrollers, sawflies and the apple curculio. At Emerson Bridge, north of the ASCHRC, apple curculio numbers were high throughout the sampling period, whereas leafroller and sawfly numbers ranked second and third, respectively.

Surveys

Carrot rust fly survey (*Psila rosae*)

This survey was carried out in Calgary with the cooperation of the M.D. of Rockyview. Orange-yellow sticky traps were placed in five home vegetable gardens during the carrot-growing season and were changed weekly. Twenty-seven traps yielded 53 flies, averaging 2 flies per trap. A home garden in Strathmore, a commercial field near Bowden, two commercial fields in the Brooks area, and carrot plots at the ASCHRC were monitored weekly throughout the growing season. No carrot rust flies were trapped; however, the traps were effective at catching the aster yellows leafhopper.

Of the many carrot samples received from various regions of the province, only those from Calgary contained rust fly damage. Samples from other areas had mainly wireworm damage.

Dutch Elm Disease Survey

The Parks Departments in Edmonton, Red Deer, Calgary, Lethbridge and Medicine Hat purchased 200 sticky traps and pheromones for monitoring elm bark beetles. The traps were distributed to the cities in mid-May. Staff monitored elm bark beetles with sticky traps at the Canada Customs station at Chief Mountain.

No elm bark beetles were trapped in 1991. A metal firewood box, paid for by the City of Medicine Hat, was installed at the Wild Horse Customs station. All of the major entry points into the province from the U.S. are now equipped with firewood containers, but Del Bonita and Aden are still without them. Seven trailer loads of confiscated firewood were removed from the Chief Mountain, Carway, Coutts, and Wild Horse border points.

Extension and Service Activities

Extension

- Presentations were made at meetings, workshops and short courses.
- Over 50 visits were made to greenhouses, interior plantscapes, farms and yards in response to requests from district agriculturists and growers.
- Several research reports, miscellaneous bulletins and newsletter items were written.

Service

The entomology technician assisted the diagnostician and information officer with insect identification and advised ASCHRC colleagues on pest control in research greenhouses, plots and the Hargrave Building atrium. He also maintained the Center's insect reference collection.

POST-HARVEST PROGRAM

Program Leader: J. Holley

The objective of this program is to maximize the longevity and quality of stored horticultural crops. Other responsibilities include diagnoses and determination of treatments for major diseases and disorders on potatoes, vegetables, turf, and herbaceous and woody ornamentals.

Because the new controlled atmosphere (CA) storage and cold rooms did not operate reliably last winter, many storage experiments had to be terminated prematurely. The major objective last season was to become familiar with the new system, to identify and then suggest solutions to each operating problem as it arose.

Research Projects

Diseases of Potatoes

Early blight resistance screening

Potato vines infected with early blight, *Alternaria solani*, were ploughed under in the fall of 1990 to prepare for disease resistance screening in 1991. Two standard cultivars and thirty-four advanced breeding lines from the Prairie Potato Breeding Program were planted in the infested soil. Levels of early blight were estimated for each replicate and means calculated for each cultivar or breeding line. Amisk, AV77531-1, MS700-70, FV8728-2, ND2042-2 and Gemchip were as resistant as Russet Burbank, the resistant standard. ND2013-4, FV7929-33, ND2667-8, WIS82-33 and AV8081-10 developed as much or more blight than Warba, the susceptible standard.

Verticillium wilt resistance screening

Cultures of *Verticillium albo-atrum* and *V. dahliae* were grown on barley seed three weeks prior to planting. Two cultivars and ten advanced breeding lines were planted with a mixture of the infested barley seed. Forty tubers from each replicate were cut and examined for evidence of vascular browning from wilt infection after harvest. The number of tubers with wilt symptoms was recorded and means calculated for each cultivar and breeding line. Some plants in the inoculated plots died before they were mature enough to set tubers. As a result, levels of wilt were low in tubers The number of tubers with vascular discoloration was as low for TXAV657-27, Amisk, ND1538-1, AV77531-1 and AV7788-9 as it was for Russet Burbank, the resistant standard. The number was as high for FV7929-33 as it was for Shepody, the susceptible standard.

Fusarium wilt resistance screening

A virulent culture of *Fusarium oxysporum* was established on barley seed and used to inoculate two cultivars and ten lines as described previously for the *Verticillium* trial. Results were recorded and means calculated for each line as previously described. The number of tubers with vascular discoloration was as low for Amisk, AV77531-1, F79054, TXAV657-27, and ND2042-2 as it was for Russet Burbank, the resistant standard. The number for FV7929-33 and AV7788-9 was as high as for Shepody, the susceptible standard.

Diseases of Turfgrass

Fairy ring control

The experimental fungicide, Anvil (ICI0523), was applied to strips of turf (5 X 50 m) at McCall Lake golf course in Calgary once each season over a two year period at rates of 750, 500, 250, 125 and 0 kg ai/ha. At the beginning of the experiment there were 20 to 30 fairy rings in each test strip. Approximately one-third of these were in an advanced stage of development with bare turf evident in the centre of each ring. Improvements in watering and fertilization by golf course staff reduced numbers of visible rings so greatly that it was difficult to assess the efficacy of the fungicide.

Even though there were only nine visible rings on average in untreated test strips at the end of the experiment, differences between treated and untreated plots were significant. Results from this experiment suggest that the application of Anvil effectively reduces the number of rings. Increasing its rate of application, however, does not improve its efficacy.

Storage Trials

Cold and CA storage of cabbage

Approximately 200 heads of April Green cabbage were donated to the ASCHRC by Bassano Grower's Co-operative for colour and weight loss studies. All cabbages were stored at 1.5°C at 95% relative humidity. One-third were placed in 7% CO_2 and 2% O_2, another third in 3% CO_2 and 2% O_2 and the remainder stored in ambient atmospheric conditions. Excessive shrinkage necessitated premature termination of the CA part of this experiment. Cabbage stored under ambient conditions heated to a temperature of 53°C in a 30 min period after a minor mechanical failure occurred and so could not be evaluated.

Service Activities

Over 100 samples from 10,000 ha of commercial potatoes were submitted to the lab for bacterial ring rot (BRR) testing in 1991. Samples from 15 different fields showed evidence of BRR infection. Over half of the BRR positives were from fields that had been planted with certified or better grade seed in the spring of 1991. Almost half of the positives were found on the variety, Sangre. Continuing high levels of BRR have alarmed the Alberta potato industry. Growers are concerned that all seed is tested in Winnipeg and would like to establish their own testing facility in Alberta. As a result, the Potato Growers Association provided a grant to establish a private testing centre for all table and seed stock potatoes. This private testing facility would be able to screen for BRR as well as test for PVY-N. It is hoped that this laboratory will be accredited by Agriculture Canada and will be able to test samples from table stock fields in 1992.

There is growing concern that DED will be introduced into Alberta in the next few years. The incidence of this disease in Manitoba and Saskatchewan is rising steadily with six reported cases of DED in Saskatchewan in 1991. One infestation occurred near Shaunavon, a community that is close to the Alberta border.

The program leader cooperated with A. Tellier in coordinating beetle survey and elm firewood confiscation programs (see Horticultural Entomology Program report). The DED committee has been increasing its efforts to alert the public to the dangers of importing diseased nursery stock or firewood. The committee needs to establish a clear direction on what to do if and when DED is introduced.

Extension Activities

There were routine queries about the identification of potato and vegetable diseases and storing potatoes, carrots and other garden vegetables. Potatoes from the ASCHRC and the Prairie Potato Breeding Program were examined in the field or in the lab, and stained for BRR as needed. Occasional farm visits were made to diagnose serious shelterbelt problems.

Seminars were given as requested including a presentation on diseases of woody and herbaceous ornamentals at the ASCHRC pruning course and a BRR orientation seminar at BRR inoculated plots at Stavely. New inspectors were able to see a wide range of symptoms on a number of different cultivars. A chapter on potato diseases was edited for the *Guidelines for the Control of Plant Diseases in Western Canada*.

Participation continued on the DED Action Committee, the Alberta Potato Research Committee, the Western Committee on Plant Disease, and the Storage Committee of the Prairie Potato Council.

REGIONAL CROP LABORATORY PROGRAM

Project Leader: J. Holley

The southern Alberta Regional Crop Laboratory (RCL) provides disease, insect, and plant identification as a service to both commercial and non-commercial clients. The lab is operated by a diagnostician and a seasonal technician. An information officer is supervised by the diagnostician.

The RCL made a total of 1274 disease, insect and plant identifications in 1991 (Tables 1-4). The information officer dealt with 2268 telephone and 143 walk-in inquiries between March and October. In May-July, there were 24-27 calls each day (Table 5).

Several serious and unusual diseases were identified in 1991. The virulent strain of canola blackleg, *Leptosphaeria maculans*, was found in one canola field near New Brigden. Tomato spotted wilt virus was confirmed on cineraria from a greenhouse at Olds. Potato late blight, *Phytophthora infestans*, was detected for the first time in over a decade in the field and in several storage facilities in southern Alberta. A number of elm trees in Edmonton infected with *Dotheriella* wilt showed flagging symptoms that closely resembled the first stages of Dutch elm disease.

Populations of the wheat stem sawfly, *Cephus cinctus*, were unusually high in 1991. Damage from insect feeding was much greater than normal. Numbers of the painted lady butterfly, *Vanessa cardui*, were high as well. It was found feeding on plant species other than its normal host, the Canada thistle. The number of submissions of household insect pests increased dramatically after the cold snap in late October. The incidence of pseudoscorpion, *Dactylochelifer copiosus*, was higher than normal in 1991. The Indian meal moth, *Plodia interpunctella*, was found in breakfast cereal boxes and in chocolate bar wrappers in several grocery stores.

Samples of purple loose strife, *Lythrum salicaria*, were submitted more frequently last year because of the publicity about its potential as a noxious weed in wetland areas. Three weeds were identified for the first time: blue mustard, *Chorispora tenella*; waterpod, *Ellisia nyctelea*; and velvet leaf, *Abutilon theophrasti*.

Table 1: Numbers of specimens submitted to the RCL from 1989 to 1991.

Type of specimen	1989	1990	1991
Plant disease identifications	852	774	727
Bacterial ring rot identifications	46	56	106
Insect identifications	320	261	282
Plant/weed identifications	149	179	159
Total	1367	1270	1274

Table 2: Summary of disease samples received in 1991 by category.

Crop category	Number of specimens	% of total	% commercial
Cereal	60	8.3	96.6
Forage	13	1.8	92.3
Fruit	80	11.0	11.5
Greenhouse crop	85	11.7	92.8
Herbaceous ornamental	28	3.9	10.7
Interior plant	16	2.2	33.3
Oilseed	28	3.9	96.4
Special crop	18	2.3	75.0
Vegetable crop	110	15.2	28.4
Woody ornamental	283	38.9	5.7
Miscellaneous	6	0.8	0.0
Total	727	100.0	
Average			35.0

Table 3: Summary of insect samples received in 1991 by category.

Crop category	Number of specimens	% of total	% commercial
Cereal	10	3.5	100.0
Forage	2	0.6	50.0
Fruit	10	3.5	20.0
Greenhouse crop	14	4.8	100.0
Herbaceous ornamental	13	4.5	15.3
Interior plant	4	1.4	50.0
Oilseed	3	1.1	100.0
Special crop	2	0.6	0.0
Vegetable crop	28	10.1	10.3
Woody ornamental	81	28.9	3.5
Miscellaneous	45	15.9	10.8
Household pests	70	25.1	6.8
Total	282	100.0	
Average			17.2

Table 4: Summary of weed samples received in 1991 by category.

Crop category	Number of specimens	% of total	% commercial
Annual crop	20	12.9	95.0
Brush covered	1	0.6	0.0
Fallow	9	5.8	88.8
Forage	6	3.8	83.3
Park, yard, garden	57	35.3	5.4
Pasture	28	17.9	89.2
Waste area	24	14.8	43.4
Water/slough	2	1.2	50.0
Miscellaneous	12	7.7	8.3
Total	159	100.0	
Average			46.1

Table 5: Summary of requests for information received in 1991 by category.

Category	Month							Total
	April	May	June	July	Aug	Sept	Oct	
Woody ornamentals	81	121	64	47	25	76	31	445
Entomology	41	69	97	104	59	50	18	438
Miscellaneous	49	57	73	64	48	53	25	369
Diseases	23	59	62	88	41	41	22	336
Fruit	29	31	41	35	23	25	15	199
Vegetables	21	18	14	28	22	33	4	140
Chemicals	9	34	36	35	16	8	1	139
Perennials	5	5	5	5	12	1	3	36
Pruning	21	13	14	16	6	18	8	96
Turf	21	17	14	6	8	18	8	92
Weeds	3	13	9	12	9	13	4	63
Potatoes	15	14	1	7	8	7	7	59
Annuals	6	9	3	5	2	10	6	41
Soil	4	11	10	3	2	1	3	34
Organic gardening	3	12	8	2	1	0	4	30
Fertilizer	6	8	6	3	1	4	0	28
Tropical plants	3	5	1	4	3	3	4	23
Landscaping	6	5	1	5	2	0	0	19
Rodents	4	7	2	1	0	3	2	19
Herbs & spices	1	0	5	2	3	5	2	17
Total	351	508	466	472	291	369	167	2703
Calls/day	14	24	27	25	18	18	9	

WEED SCIENCE PROGRAM

Program Leader: R. Esau
Technologist: B. Kruger

The objectives of the Weed Science Program are:

- to improve weed control practices for vegetable, potato, fruit, nursery and special crops by evaluating commercial and experimental herbicides and crop management practices,

- to assist with the diagnosis of herbicide injury and the identification of plants submitted to the ASCHRC Regional Crop Laboratory, and

- to provide weed control information to both commercial and non-commercial growers.

Further details of all research trials appear in the *1991 Weed Control Trials*, ASCHRC Pamphlet 92-14. All rates quoted in this program report are in terms of active ingredient per hectare.

Research Projects

Weed Control in Fruit Crops

During 1991, Casoron 4G for established saskatoons and Treflan/Rival for new plantings were approved by the Minor Use of Pesticides Program.

One field trial was conducted to evaluate the response of actively growing saskatoons to clopyralid (Lontrel) as an overtop treatment. New growth was deformed by this herbicide. This herbicide is particularly effective for controlling Canada thistle and legumes. It will be further evaluated in 1992. In addition, a growth chamber trial is in progress to evaluate the competitive effects of dandelion on saskatoon.

Weed Control in Vegetable Crops

Cabbage

A number of new herbicides for crucifers were tested at the ASCHRC and at Edmonton (by research contract) on cabbage. These included quinclorac, pyridate (Lentagran) and napropamide (Devrinol). No significant crop injury occurred at either site. At the ASCHRC pyridate, napropamide and trifluralin (standard treatment) controlled redroot pigweed. These same three products controlled chickweed at the Edmonton test site. Quinclorac did not control chickweed nor redroot pigweed.

Squash

Effects of tillage and minimum soil preparation, in combination with glyphosate applications prior to the emergence of squash, were investigated. Production and earliness were both superior for squash grown on cultivated soil in comparison to seeding into stubble or a barley cover crop. Loss of seeds to rodents was greater in the minimum soil preparation sites than on cultivated soil.

Onions

The effects of bromoxynil (Pardner) applied to onions as a preemergent spray (postemergent to weeds) was retested in 1991. The objective was to control broad-leaved weeds, particularly wild buckwheat, without affecting grasses planted to reduce soil erosion by wind. Crop tolerance was acceptable to good. In other trials with onions, pendimethalin (Prowl) was tested at the ASCHRC and in a grower's field near Taber. Pendimethalin was not phytotoxic to onions; this product received registration in 1991 for use on muck soils.

Peas

In Stampede processing peas, imazethapyr (Pursuit) controlled wild tomato, wild mustard and redroot pigweed without injuring the crop. Basagran Forte (BAS 35140) caused temporary injury when applied alone or with imazethapyr. Control of lamb's-quarters was enhanced by the addition of BAS 35140 with imazethapyr. In a second trial with peas, four graminicides, fluazifop-p-butyl (Fusilade II), clethodim (Select), fenoxaprop-p-ethyl (Excel Super) and sethoxydim (Poast), were tested alone and in some combinations for the control of volunteer cereals, wild oats and green foxtail. In this trial, rain, which fell shortly after the sprays were applied, reduced weed control. Yields of fresh pea pods did not differ significantly among herbicidal treatments.

Weed Control in Potatoes

The effect of simulated carryover of trifluralin and ethalfluralin was evaluated for Russet Burbank potatoes. No yield reductions were observed as a result of the simulated residue treatments. In a separate trial, a sulfonylurea herbicide was tested for crop tolerance and weed control. This product produced temporary crop injury, even at the lowest rate tested; total yield was unaffected but marketable yield was drastically reduced for Russet Burbank and Shepody potatoes.

In cooperation with industry, potatoes were treated with clethodim (Select) and glufosinate-ammonium (Ignite). Residue levels (45 and 60 days after treatment) of each will be determined by the respective companies.

Weed Control in Nursery Crops

The granular herbicides trifluralin (Treflan), napropamide (Devrinol) and oxadiazon (Ronstar), and liquid pendimethalin (Prowl) were applied to nursery containers of forsythia, Korean bushcherry, and golden elder. These crops were not injured by any of the herbicides. Bushcherry formed a dense canopy so that most weeds were controlled. Napropamide and oxadiazon provided the best control of common groundsel;

all herbicides controlled lamb's-quarters. One additional test with graminicides on seven species (potentilla, Korean bushcherry, Blue Danube juniper, Little Giant cedar, Dropmore honeysuckle, double flowering plum and Gold Flame spiraea) was also conducted. No crop injury was observed. Sethoxydim (Poast) and clethodim (Select) controlled green foxtail, although control was reduced where heavy crop canopy prevented the sprays from reaching the weeds.

Weed Control in Herbs and Spices

A project funded by Farming for the Future was continued to determine how weed control and other agronomic practices affected the production of basil, lemon bergamot, caraway, mint and three other perennial herbs.

Herbigation

EPTC (Eptam) and metolachlor (Dual) were applied with a backpack sprayer to control hairy nightshade in dry beans. This was followed immediately by irrigation to simulate herbigation. Herbicides were applied after the initial emerging weeds had been controlled by cultivation. No crop injury was observed and weed control was good with or without herbigation treatments.

A herbigation trial for the minor use registration of EPTC (Eptam) plus metribuzin (Sencor) for use in potatoes was discontinued early because advanced weed growth at the time of simulated herbigation was not controlled. The results would therefore not have been meaningful.

Herbicide Carry-Over

Wheat, canola and potatoes were seeded across plots treated with imazethapyr (Pursuit) at 25-100 g/ha in 1989 and 1990. Canola and potatoes were injured by imazethapyr soil residues from 1989 and 1990 applications of 75 and 100 g/ha; wheat biomass was not affected. A third recropping trial was begun in 1991. In the initial year of all three tests, the entire plot area was seeded to pinto beans. These plots will be recropped in 1992.

Pulse and Special Crops

Three separate trials were conducted with three forage brassicas, in cooperation with H. Najda, Special Crops and Agronomy Section, to assess their tolerance to preplant incorporated trifluralin (Treflan). No phytotoxicity was observed so it is expected these data will permit the addition of the Prairie Provinces to an existing registration covering eastern Canada and British Columbia.

In a trial with pinto beans, bentazon (Basagran Forte) imazethapyr (Pursuit) controlled redroot pigweed, lamb's-quarters, wild tomato and wild mustard. Crop injury was not observed and yields were unaffected by the herbicidal treatments.

Extension and Service Activities

Weed control recommendations were provided to growers by telephone, letter or office/farm visits. Presentations were made at several grower meetings. A number of articles were contributed to the ASCHRC Crop Protection Newsletter. Assistance was also provided to the Regional Crop Laboratory for plant identification and crop injury diagnosis.

A report was prepared for the Research Appraisal and Planning Committee, Expert Committee on Weeds (Western Canada Section), covering eight vegetable crops. The weed scientist's term as a council representative of the Alberta Institute of Agrologists was completed in March. He participated in reviewing efficacy guidelines for herbicide registration.

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- Harvesting Essential Oil Crops at Different Stages of Development. R. Gaudiel and E. Russell
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- Effects of Imzethapyr on Rotation Crops - 1990

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APPENDIX I. METEOROLOGICAL REPORT

Summary of 1991 Weather Conditions

Temperatures followed long-term averages with two exceptions: February, with a mean temperature of -0.5°C compared with the long-term average for that month of -8.6°C. October was colder than average with a mean temperature of 0.3°C compared with the long-term average temperature of 6.1°C.

Precipitation of 106.2 mm in May was 250% of normal. Higher-than-normal precipitation also occurred in June with total accumulated rainfall of 86.2 mm. This was 150% of normal. Total precipitation for the growing season (May-September) was 20% higher than the long-term average. Hours of bright sunshine in February were 60% of the long-term average. Last frost in the spring was on May 5 and the first frost in the fall was on September 17 for a total frost-free period of 134 days. Total Corn Heat Unit accumulation for the frost-free period was 2370.6.

Table 6. Environmental data recorded at the Alberta Special Crops and Horticultural Research Center

	Temperature (°C)				
Month	Max.	Min.	Mean	Total precipitation (mm)	Sunshine (h)
January	6.2	-35.1	-14.4	1.0	105.4
February	14.6	-15.6	-0.5	13.9	70.4
March	18.4	-22.1	-1.9	2.8	167.4
April	23.6	-7.1	8.3	42.8	223.1
May	27.3	-3.9	11.7	106.2	244.9
June	27.6	5.0	16.3	86.2	227.2
July	31.8	6.8	19.3	23.2	325.5
August	37.0	5.8	21.4	36.6	287.5
September	30.7	-5.7	12.5	4.4	192.9
October	28.4	-27.9	0.3	10.3	148.3
November	12.9	-22.7	-4.9	12.5	98.4
December	12.2	-18.7	-3.3	0.0	80.6
Mean temperature			5.4		
Total precipitation				339.6	

APPENDIX II. TERMS OF REFERENCE ASCHRC ADVISORY COMMITTEE

Purpose

The ASCHRC Advisory Committee is a permanent committee established to be advisory to the ASCHRC Director.

Membership

Membership on the committee is by invitation, and includes representation from industry associations and associated organizations. Representation is by appointment through the association or by the Director, ASCHRC.

1. Industry Representatives - Grower Organizations

   - Landscape Alberta Nursery Trades Association
   - Alberta Greenhouse Growers Association
   - Alberta Vegetable Growers Marketing Board
   - Alberta Fresh Vegetable Marketing Board
   - Alberta Market Gardeners Association
   - Alberta Potato Marketing Board
   - Pulse Growers Association of Alberta
   - Flowers Canada - Alberta Region
   - Fruit Growers Society of Alberta
   - Red Hat Co-operative

2. Industry Representatives - Non-grower

   - Alberta Potato Processors
   - Horticultural Supply Specialists
   - Empress Foods Ltd.

3. Associated Organizations

   - University of Alberta - Plant Science
   - Agriculture Canada Research Station - Lethbridge
   - Alberta Agriculture Regional Director (Region I or II)
   - Alberta Tree Nursery and Horticulture Centre - Director
   - Field Crops Branch, Alberta Agriculture - Head
   - Director - Plant Industry Division

4. Community Representative
   - Bow Island

5. Director, ASCHRC

Objectives

1. The committee shall regularly review and critique ASCHRC programs.

2. The committee shall recommend new research and extension program initiatives and assist in the establishment of priorities for existing programs.

3. The committee shall deal primarily with matters pertaining to the ASCHRC research and extension programs, and not necessarily with broad industry related problems, *e.g.* marketing, except as they may influence program objectives.

Membership Responsibility

1. To attend all meetings as scheduled, and to represent their area of interest from an overall industry point of view.

2. To provide input to meetings reflecting the needs of agency members and producers which they represent to ensure that they be addressed by the ASCHRC. Written submissions are preferred.

3. In regard to Committee Objective #1, members should attend regularly scheduled **program** reviews in their commodity area. (These reviews are planned biennially.)